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ABSTRACT

The strategies used by upper-division college students (juniors and seniors) to learn information in a variety of task materials were assessed. Fifty juniors and seniors enrolled in an undergraduate psychology course at the Univeristy of Texas at Austin were administered the Learning Activities Questionnaire (LAQ) along with an accompanying booklet entitled Seven Learning Activities. Part 1 of the LAQ asked respondents to describe any methods or mental tricks they used to learn and remember the information, events or ideas contained in the activities booklet. The booklet contained two free recall lists, three paired-associates lists and two reading passages. After writing a description of each strategy, participants were then asked to respond to several questions on how the study method was learned and why it helped in learning new material. The remainder of the LAQ was a checklist of specific strategies used by learners in mapping out learning strategies. Responses were then classified into one of five strategy categories: rote, physical, imagery, elaboration and grouping. Results of the study showed that upper-division college students use imagery, elaboration and grouping strategies for free recall tasks; all five strategy categories for paired-associate tasks; and physical, imagery and grouping strategies for reading passages. The researchers were disturbed to find that respondents appeared to lack the elaboration strategy for reading tasks, and suggest that a number of undergraduates may need some remedial training in this learning method. A number of statistical tables are appended, along with a list of references and a sample LAQ. (DC)

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College students - how do they learn?

by

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The purpose of this study was to identify the types of strategies used by upper-division college students (juniors and seniors) to learn the information in a variety of task materials. A second purpose was to compare the types of strategies reported by college students with data obtained from other groups at different educational levels. A long-term goal of this kind of investigation is to identify the kinds of strategies used by effective learners so that deficits in less effective learners can be identified and steps can be taken to remediate these deficits, where possible.

A more traditional approach to identifying learner deficits has focused on areas of study skills such as underlining and notetaking, time management, attitudes, and motivation. Most previous research has not focused on identifying the strategies a learner uses to actively process the information presented in learning tasks. Two more recently developed instruments are designed to assess cognitive components in learning as well as more traditional study skills. These instruments are the Inventory of Learning Processes (ILP) developed by Schmeck, Ribich, and Ramanaiah (1977) and the Learning Strategy Inventory (LSI) developed by Dansereau, Long, McDonald

[1]The research reported in this paper was supported in part by Contract No. DAHC19-76-C-0026 from the Defense Advanced Research Projects Agency.

and Actkinsin (Note 1). Both sets of investigators based their inventory items primarily upon their intuitive notions of how processes described in current learning literature might be used by students engaged in studying new material. Due to this approach, these authors may have overlooked some effective strategies or novel applications of previously identified strategies that may be used by effective and efficient learners.

The instrument used in this study, the Learning Activities Questionnaire (LAQ), differs from the instruments described above in two major ways: the strategy categories used for classifying responses were derived from the data obtained in a semi-structured interview study with relatively successful undergraduate students, and this instrument uses an open-ended question format as well as a checklist format for obtaining responses. This instrument underwent several pilot tests before a final version was developed.

A booklet entitled Seven Learning Activities containing two free recall lists, three paired-associate lists, and two reading passages, is used to present the learning tasks. Part I of the LAQ asks the respondents to describe any methods or mental tricks they would use to learn and remember the information, events or ideas contained in each set of activities. The respondents are referred to the Seven Learning Activities booklet for examples of each type of task. After writing a description of each strategy, participants are then asked to respond to several questions such as how the method was learned and how it helps to learn new material. Space is provided for four different strategies for each of the three types of tasks. The remainder of the LAQ is composed of a checklist of specific strategies which learners use to indicate the types of strategies they might use for each of the three types of tasks.

Weinstein, Wicker, Cubberly, Roney, and Underwood (Note 2) have administered the LAQ to individuals at five different educational levels:

graduate students (GRAD), community college students (CC), high school graduates (HS), general equivalency diploma holders (GED), and persons who had not completed high school (ND). These respondents were presented with the LAQ and Seven Learning Activities booklet. In groups of 10 to 50, participants were asked to complete the questionnaire. Proctors were available to answer any questions. Completion time ranged from 40 to 90 minutes with the median being 70 minutes.

Responses were classified into one of five strategy categories or a no-strategy category for the free recall and paired-associate tasks. The categories were:

Rote: Strategies classified as rote involve repetition of the to-be-learned material. For example, the statement "I say the words over and over" would be classified as rote.

Physical: This category includes noting physical similarities and differences between words and parts of words or using only a portion of the stimulus. For example, "I use the first letters to make a word" and "They both start with the same letter--M" would be classified as physical.

Imagery: Strategies classified as imagery involve the use of mental imagery. For example, the statement "I picture the words in my head" would be considered an imagery strategy.

Elaboration: Strategies under this classification involve ways to make the to-be-learned material more meaningful by such methods as relating it to previous knowledge or experiences, or thinking about the logical relationships.

Grouping: Strategies classified in this category involve dividing the to-be-learned material into meaningful categories.

None: Sometimes respondents do not give enough information for the grader to classify a response, or they make irrelevant responses. In these cases, the response is classified as none.

For the reading tasks there were once again five categories, but grouping was eliminated and the category of active rote was added.

Active Rote: When the respondent reports some organization of the material such as selecting out parts of the reading to be reread, outlining, and underlining, this would be classified as active rote.

The general findings of this data were that graduate students used each of the learning strategies significantly more than the other four groups and that the three non-college groups reported the lowest use of learning strategies with the exception of rote methods. Since much of the research literature in human learning and memory suggests that the use of verbal and imaginal elaboration strategies should result in performance that is superior to that resulting from the use of simple practice and physical analysis strategies it seems reasonable that at higher levels of education learners would report using more cognitive learning strategies as well as a greater variety of strategies. The present study was designed to find out if college students reported use of strategies would be similar to that reported by graduate and community college students. In addition, it was hypothesized that the three college student groups would report the use of verbal and imaginal elaboration strategies more frequently than respondents at a non-college educational level.

Method

Participants. The LAQ was administered to 50 individuals, 25 juniors and 25 seniors enrolled in an undergraduate educational psychology course at The University of Texas at Austin. Participation in this research was a part of their course requirement.

Materials. The materials for this study included the LAQ and the Seven Learning Activities booklet. (Samples of these materials can be found in Appendices I and II respectively.

Procedure. Participants completed the questionnaire in groups of 4-10 persons. The administration procedure was the same as that described for the earlier studies. Completion time was approximately 1 hour.

Results & Discussion

The results of Part I only will be discussed here. In another study by Weinstein et al. (Note 2) it was found that the checklist format of Part II allowed for an inflated reporting of strategy use. In Part I, responses were rated as falling into one of five strategy categories or a no-strategy category as in the above study. For the free recall and paired-associate tasks the categories were: rote, physical, imagery, elaboration, grouping, and none. For the reading tasks, once again grouping was eliminated and the category of active rote was added.

The inter-rater agreement on a subset of 35 questionnaires was 92%. The number of strategies used by each respondent in each of the strategy categories was tabulated separately for each of the three task types.

Further analysis of the data were then conducted to determine the differences in reported strategies between respondents at various educational levels. The data collected on college students in this study was compared with the data collected by Weinstein et al. on graduate students, community college students, general equivalency diploma holders, high school graduates, and those with no high school diploma. Fifteen one-way analyses of variance were performed to examine the differences among the means of the six groups (educational level) on their reported use of the five strategy categories for each of the three types of tasks. Post hoc analyses were performed using Duncan's Multiple Range Test at a .05 level of significance. The results of each one-way analysis and the corresponding multiple range test appear in Tables 1-15. Figures 1 to 3 depict the percentages of individuals in each of the six groups who reported using one or more strategies for each type of task. Although there were some inconsistencies in the data, a number of patterns were found. These will be discussed separately for each of the

three types of tasks.

Free Recall Tasks. The analyses revealed significant differences among the groups in the mean number of strategies reported for each of the categories. With the exception of rote and physical strategies, college and graduate students reported significantly greater use of all strategy types than did the ND, GED, HS, or CC groups. The college groups, however, reported using a significantly greater number of imagery strategies than did the graduate group.

Paired Associate Tasks. Significant differences among the groups were found on the use of all five strategy categories for the paired-associate tasks. With the exception of the rote strategy, no significant differences appeared among the non-college groups. All three college groups reported significantly greater use of imagery strategies. The college and graduate groups reported significantly greater use of elaboration than that reported by the other four groups. The graduate group reported significantly greater use of grouping strategies than the five other groups and the college students reported significantly greater use of grouping strategies that the GED, ND, and CC groups.

Reading Tasks. Significant differences among the group means were found for each of the five strategy categories. With the exception of rote and elaboration strategies, college students reported significantly greater use of strategies than the three non-college groups. The college group also reported a significantly greater use of imagery than any of the other five groups. Graduate students reported significantly greater use of rote, physical, and elaboration strategies than all other groups. The non-college groups reported no significant differences in reported use of strategies with exception of the GED group reporting greater use of active rote strategies than the no-high school diploma group.

An examination of the frequency data reveals that both the college and graduate groups' most frequently reported strategy for free recall and paired-associate tasks was elaboration and for reading tasks was active role. For community college students the most frequently reported strategies for the free recall tasks were rote and grouping; for the paired-associate tasks were rote and elaboration; and for reading tasks were passive rote and elaboration. Rote strategies were reported as the most frequent strategy used by the non-college groups for all three tasks.

These results partially support the hypothesis that learners at higher levels of education do report more frequent use of verbal and imaginal elaboration strategies than learners at lower educational levels. The most disturbing finding is that upper-division college students report using relatively little elaboration for reading tasks. This group does not appear to lack the strategy, as shown by its frequent use in free recall and paired-associate tasks, but the students are not reporting that they apply elaboration strategies to reading tasks. This finding indicates that a number of undergraduate students may need some remedial training in the use of effective elaboration strategies for learning from text.

Additional research is needed to identify the types of strategies used by effective learners at different developmental levels. This information could be used to diagnose the processing deficits in less successful learners. Training programs could then be developed to enhance the information-processing capabilities of educationally disadvantaged students.

REFERENCE NOTES

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TABLE 1

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Rote Strategies in the Free Recall Tasks.

Source	df	SS	MS	F	p
Between groups	5	13.91	2.78	5.12	<.001
Within groups	375	203.91	.54		
Total	380	217.82			

Educational Level

	UG	CC	N	GRAD	HS	GED
N	50	75	49	35	86	86
Mean	.42	.55	.59	.74	.84	.97
Standard Deviation	.70	.53	.50	.92	.81	.86
*Subsets						

Summary of Significant Differences Between Means (p<.05)

HS>UG,CC
GED>UG,CC,N

*Within subsets, means do not differ significantly from one another.

TABLE 2

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Physical Strategies in the Free Recall Tasks.

Source	df	SS	MS	F	p
Between groups	5	13.14	2.63	10.58	<.001
Within groups	375	93.15	.25		
Total	380	106.29			

Educational Level

	GED	UG	N	HS	CC	GRAD
N	86	50	49	86	75	35
Mean	.14	.14	.24	.30	.40	.80
Standard Deviation	.35	.35	.43	.53	.57	.76
*Subsets						

Summary of Significant Differences Between Means (p<.05)

HS>GED
CC>GED,UG
GRAD>CC,HS,N,UG,GED

*Within subsets, means do not differ significantly from one another.

TABLE 3

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Imagery Strategies in the Free Recall Tasks.

Source	df	SS	MS	F	p
Between groups	5	44.72	8.94	46.54	<.001
Within groups	375	72.07	.19		
Total	380	116.79			

Educational Level

	N	GED	HS	CC	GRAD	UG
N	49	86	86	75	35	50
Mean	.08	.09	.10	.12	.34	1.12
Standard Deviation	.28	.29	.34	.33	.54	.82
*Subsets						

Summary of Significant Differences Between Means (p<.05)

GRAD>N,GED,HS,CC
UG>GRAD,CC,HS,GED,N

*Within subsets, means do not differ significantly from one another.

TABLE 4

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Elaboration Strategies in the Free Recall Tasks.

Source	df	SS	MS	F	p
Between groups	5	29.17	5.83	15.40	<.001
Within groups	375	142.08	.38		
Total	380	171.25			

Educational Level

	N	HS	GED	CC	UG	GRAD
N	49	86	86	75	50	35
Mean	.27	.29	.40	.44	.94	1.09
Standard Deviation	.49	.51	.64	.55	.84	.70
*Subsets						

Summary of Significant Differences Between Means ($p<.05$)

UG,GRAD>N,HS,GED,CC

*Within subsets, means do not differ significantly from one another.

TABLE 5

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test of Grouping Strategies in the Free Recall Tasks.

Source	df	SS	MS	F	p
Between groups	5	28.32	5.66	17.28	<.001
Within groups	375	122.90	.33		
Total	380	151.22			

	Educational Level					
	GED	N	HS	CC	GRAD	UG
N	86	49	86	75	35	50
Mean	.24	.31	.35	.53	.80	1.06
Standard Deviation	.46	.47	.66	.53	.47	.77
*Subsets	———			———	———	———

Summary of Significant Differences Between Means ($p<.05$)

UG>GRAD,CC,HS,N,GED
GRAD>CC,HS,N,GED
CC>HS,N,GED

*Within subsets, means do not differ significantly from one another.

TABLE 6

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Rote Strategies in the Paired-Associate Tasks.

Source	df	SS	MS	F	p
Between groups	5	10.45	2.09	5.22	<.001
Within groups	375	150.22	.40		
Total	380	160.67			

Educational Level

	UG	N	CC	GRAD	GED	HS
N	50	49	75	35	86	86
Mean	.34	.57	.59	.69	.79	.85
Standard Deviation	.59	.50	.59	.63	.67	.71
*Subsets						

Summary of Significant Differences Between Means (p<.05)

HS>CC,N,UG
GED>UG

*Within subsets, means do not differ significantly from one another.

TABLE 7

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Physical Strategies in the Paired-Associate Tasks.

Source	df	SS	MS	F	p
Between groups	5	1.93	.3856	2.24	<.05
Within groups	375	64.62	.17		
Total	380	66.55			

Educational Level

	N	GED	HS	UG	GRAD	CC
N	49	86	86	50	35	75
Mean	.10	.10	.12	.16	.17	.29
Standard Deviation	.31	.41	.36	.37	.38	.56
*Subsets						

Summary of Significant Differences Between Means ($p<.05$)

CC>N,GED,HS

*Within subsets, means do not differ significantly from one another.

TABLE 8

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Imagery Strategies in the Paired-Associate Tasks.

Source	df	SS	MS	F	p
Between groups	5	11.45	2.29	16.38	<.001
Within groups	375	52.41	.14		
Total	380	63.86			

Educational Level

	HS	GED	N	CC	UG	GRAD
N	86	86	49	75	50	35
Mean	.06	.06	.06	.20	.38	.60
Standard Deviation	.24	.24	.24	.40	.53	.65
*Subsets						

Summary of Significant Differences Between Means (p<.05)

GRAD>UG,CC,N,GED,HS
UG>CC,N,GED,HS
CC>N,GED,HS

*Within subsets, means do not differ significantly from one another.

TABLE 9

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Elaboration Strategies in the Paired-Associate Tasks.

Source	df	SS	MS	F	p
Between groups	5	71.30	14.26	31.93	<.001
Within groups	375	167.51	.45		
Total	380	238.81			

	Educational Level					
	GED	HS	N	CC	UG	GRAD
N	86	86	49	75	50	35
Mean	.29	.30	.32	.53	1.14	1.63
Standard Deviation	.55	.60	.47	.60	.97	.91
*Subsets						

Summary of Significant Differences Between Means (p<.05)

GRAD>UG,CC,N,HS,GED
UG>CC,N,HS,GED
CC>HS,GED

*Within subsets, means do not differ significantly from one another.

TABLE 10

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Grouping Strategies in the Paired-Associate Tasks.

Source	df	SS	MS	F	p
Between groups	5	2.35	.47	7.47	<.001
Within groups	375	23.59	.063		
Total	380	25.94			

Educational Level

	GED	N	CC	HS	UG	GRAD
N	86	49	75	86	50	35
Mean	.01	.02	.04	.07	.14	.29
Standard Deviation	.11	.14	.20	.26	.35	.46
*Subsets						

Summary of Significant Differences Between Means (p<.05)

GRAD>UG,HS,CC,N,GED
UG>CC,N,GED

*Within subsets, means do not differ significantly from one another.

TABLE 11

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Passive Rote Strategies in Reading Comprehension Tasks.

Source	df	SS	MS	F	p
Between groups	5	6.57	1.31	3.27	<.05
Within groups	375	150.57	.40		
Total	380	157.14			

Educational Level

	UG	GED	CC	HS	N	GRAD
N	50	86	75	86	49	35
Mean	.34	.48	.49	.51	.55	.89
Standard Deviation	.56	.63	.55	.68	.50	.90
*Subsets						

Summary of Significant Differences Between Means (p<.05)

GRAD>N,HS,CC,GED,UG

*Within subsets, means do not differ significantly from one another.

TABLE 12

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Active Rote in the Reading Comprehension Tasks.

Source	df	SS	MS	F	p
Between groups	5	58.16	11.63	32.43	<.001
Within groups	375	134.49	.36		
Total	380	192.65			

Educational Level

	N	HS	CC	GED	GRAD	UG
N	49	86	75	86	35	50
Mean	.06	.20	.23	.31	.91	1.26
Standard Deviation	.24	.43	.45	.58	.82	1.01
*Subsets						

Summary of Significant Differences Between Means (p<.05)

UG>GRAD,GED,CC,HS,N
GRAD>GED,CC,HS,N
GED>N

*Within subsets, means do not differ significantly from one another.

TABLE 13

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Physical Strategies in the Reading Comprehension Tasks.

Source	df	SS	MS	F	p
Between groups	5	23.96	4.79	31.94	<.001
Within groups	375	56.27	.15		
Total	380	80.24			

Educational Level

	HS	GED	N	UG	CC	GRAD
N	86	86	49	50	75	35
Mean	-	-	.08	.28	.37	.83
Standard Deviation	-	-	.28	.45	.54	.79
*Subsets						

Summary of Significant Differences Between Means (p<.05)

GRAD>CC,UG,N,GED,HS
UG,CC>N,GED,HS

*Within subsets, means do not differ significantly from one another.

**No use of these strategies was reported by subjects in these groups.

TABLE 14

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Imagery in the Reading Comprehension Tasks.

Source	df	SS	MS	F	p
Between groups	5	7.92	1.58	15.20	<.001
Within groups	375	39.09	.10		
Total	380	47.01			

Educational Level

	HS	GED	N	CC	GRAD	UG
N	86	86	49	75	35	50
Mean	.01	.02	.04	.08	.14	.46
Standard Deviation	.11	.15	.20	.27	.36	.71
*Subsets						

Summary of Significant Differences Between Means (p<.05)

UG>GRAD,CC,N,GED,HS

*Within subsets, means do not differ significantly from one another.

TABLE 15

Summary of Results of the Analysis of Variance and Duncan's Multiple Range Test for Elaboration in the Reading Comprehension Tasks.

Source	df	SS	MS	F	p
Between groups	5	10.86	2.17	8.01	<.001
Within groups	375	101.65	.27		
Total	380	112.51			

Educational Level

	UG	GED	N	HS	CC	GRAD
N	50	86	49	86	75	35
Mean	.06	.15	.24	.26	.44	.66
Standard Deviation	.24	.39	.48	.56	.55	.87
*Subsets						

Summary of Significant Differences Between Means (p<.05)

GRAD>CC,HS,N,GED,UG
CC>GED,UG

*Within subsets, means do not differ significantly from one another.

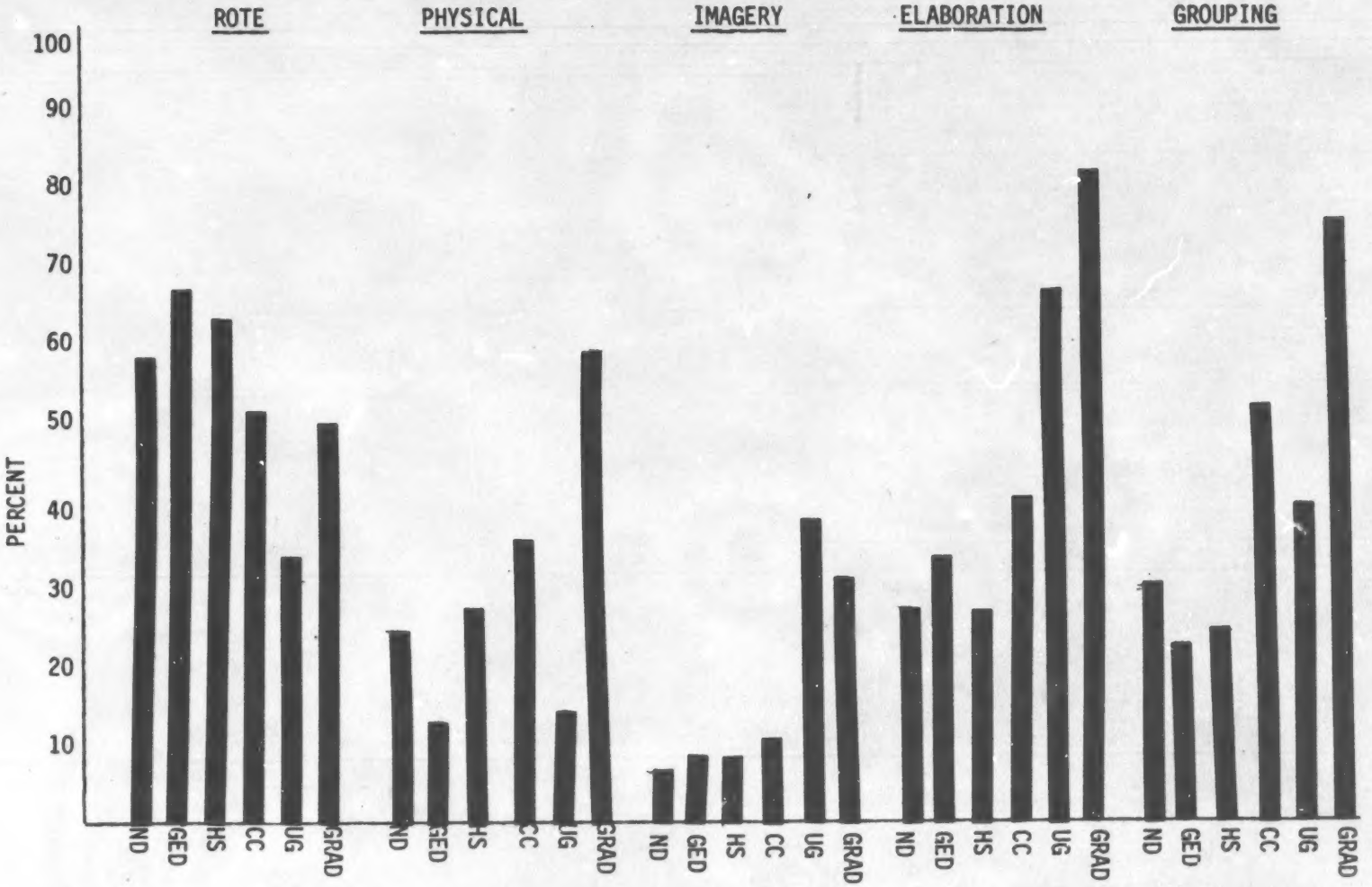

Figure 1. Percent of each group reporting use of the strategies on the free recall tasks.

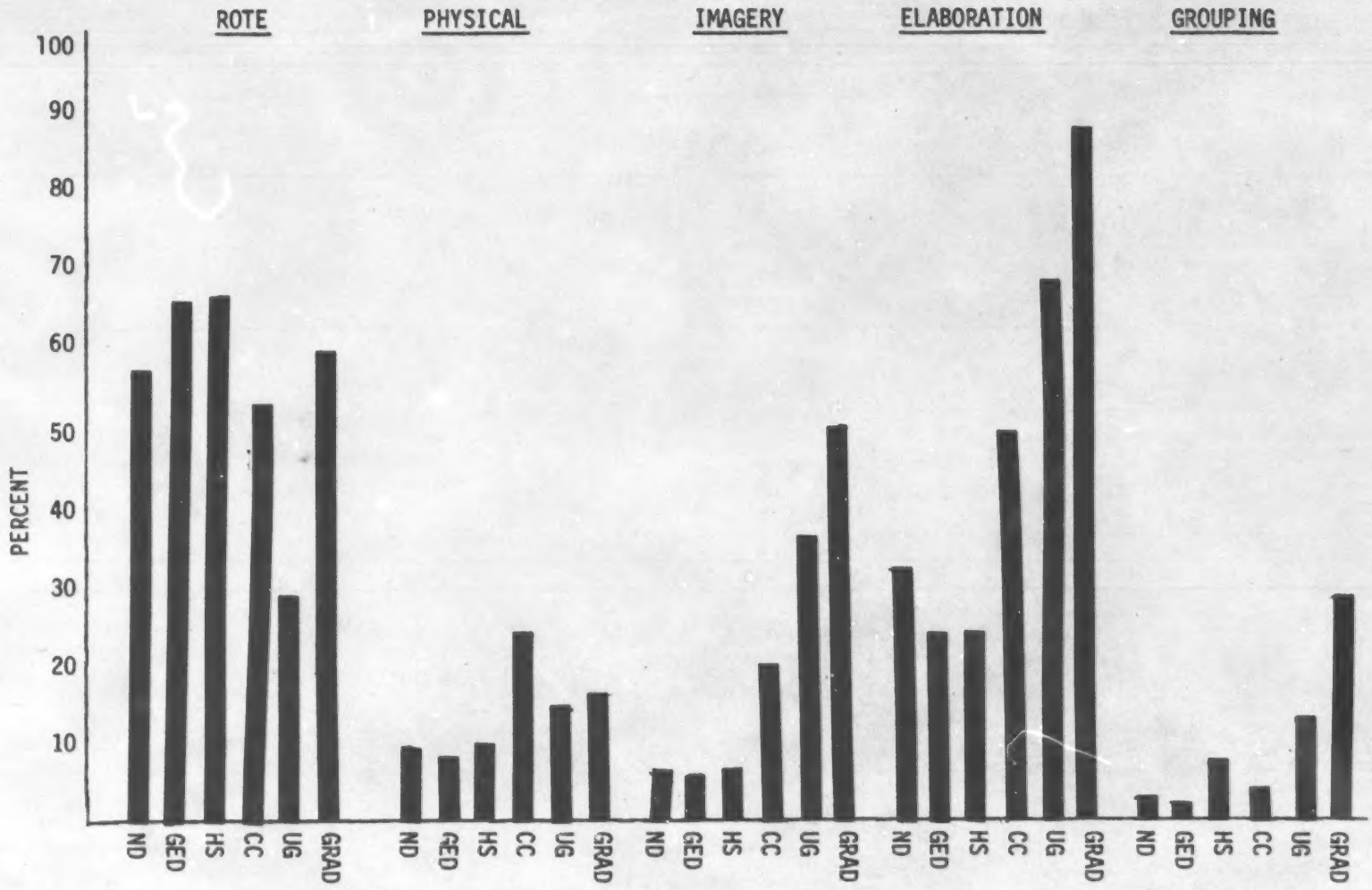

Figure 2. Percent of each group reporting use of the strategies on the paired-associate tasks.

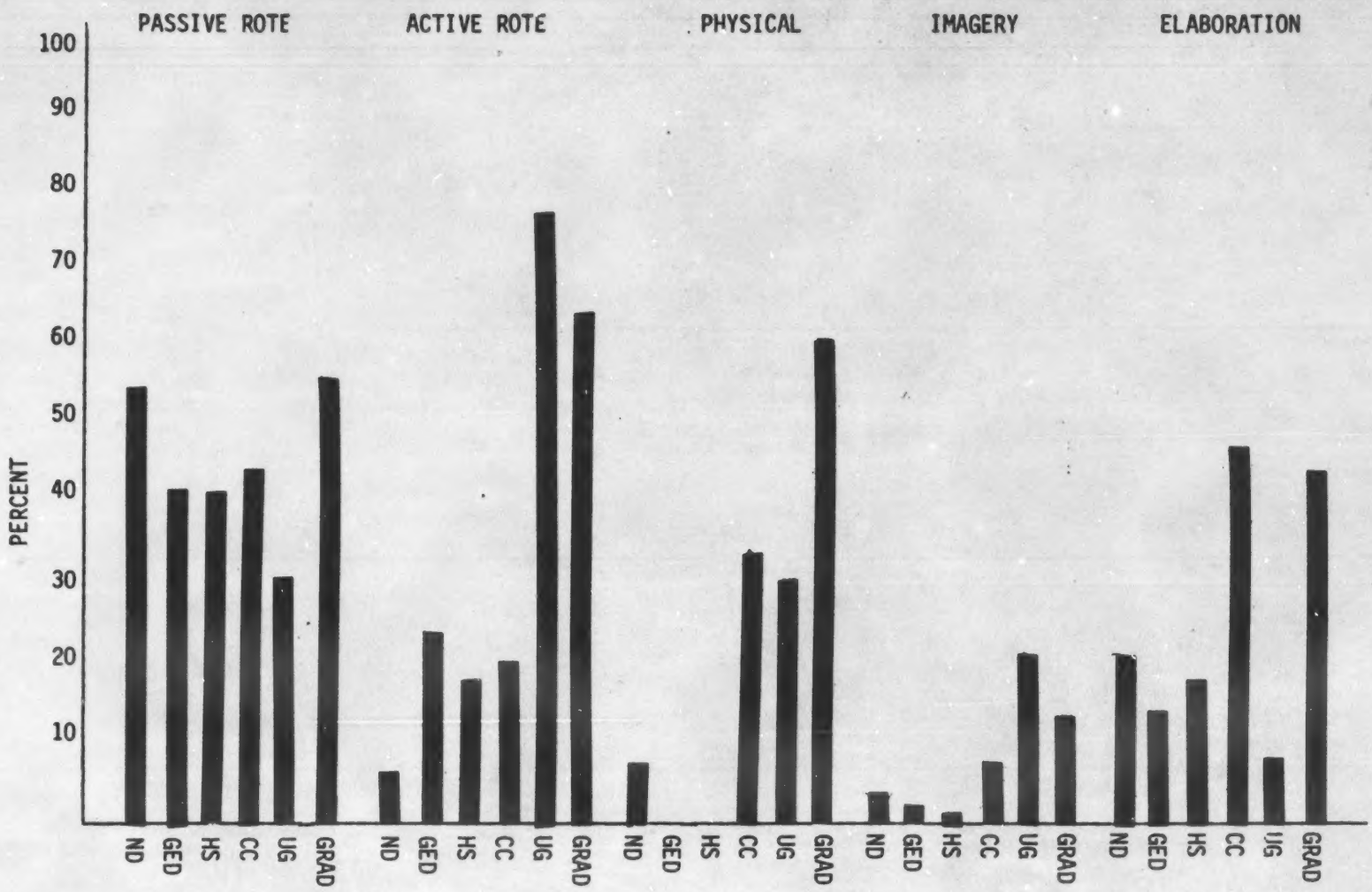

Figure 3. Percent of each group reporting use of the strategies on the reading comprehension tasks.

APPENDIX I-

Sample Free Recall lists from the Seven Learning Activities booklet

ACTIVITY ONE	ACTIVITY TWO
ANECDOTE	GRASSHOPPER
VOLUME	ANIMAL
HEALTH	REPTILE
SHOCK	LASSIE
RESEARCH	BIRD
CHAOS	MAMMAL
FREEDOM	WASP
BACKGROUND	DOG
POLLUTION	CANARY
SETTLEMENT	EAGLE
MILEAGE	COLLIE
LAW	INSECT
BLESSING	ALLIGATOR
LIFE	HORSE
RHEUMATISM	GIRAFFE

Sample from the Learning Activities Questionnaire 29

I. a) Describe one method or "mental trick" you would use to help you remember and understand the readings in either Activity Six or Activity Seven.

b) How did you learn to use this kind of method?
taught by 1) self ___ 2) teacher ___ 3) friends ___ 4) parents ___
5) other (specify) _____

c) How old were you when you first learned to use this method?
1) pre-school ___ 2) elementary school ___ 3) junior high ___
4) high school ___ 5) since high school ___

d) What does this method do to help you learn?

e) Do you use this method for other learning tasks? Yes ___ No ___
If yes, what other learning tasks?

How often? 1)seldom ___ 2) sometimes ___ 3) often ___ 4) very often ___

f) Additional Comments:

II. a) Describe one method or "mental trick" you would use to help you remember and understand the readings in either Activity Six or Activity Seven.

b) How did you learn to use this kind of method?
taught by 1) self ___ 2) teacher ___ 3) friends ___ 4) parents ___
5) other (specify) _____

c) How old were you when you first learned to use this method?
1) pre-school ___ 2) elementary school ___ 3) junior high ___
4) high school ___ 5) since high school ___

d) What does this method do to help you learn?

e) Do you use this method for other learning tasks? Yes ___ No ___
If yes, what other learning tasks?

How often? 1) seldom ___ 2) sometimes ___ 3) often ___ 4) very often ___

f) Additional Comments: